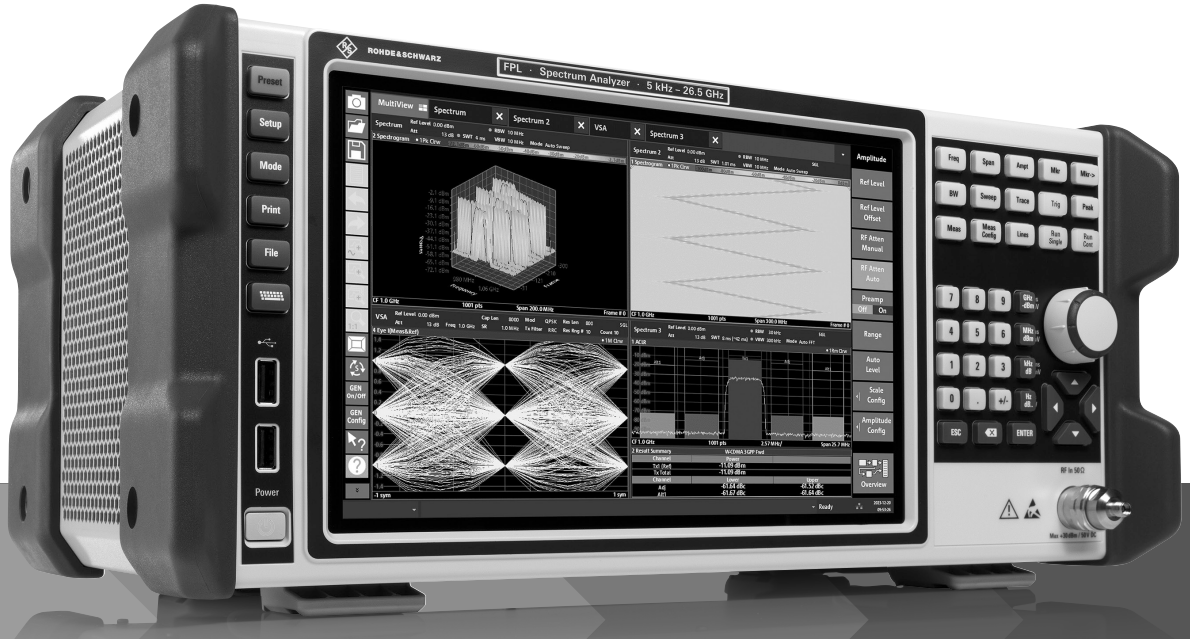
FPL
SPECTRUM ANALYZER

Specifications



Specifications
Version 15.00

ROHDE&SCHWARZ
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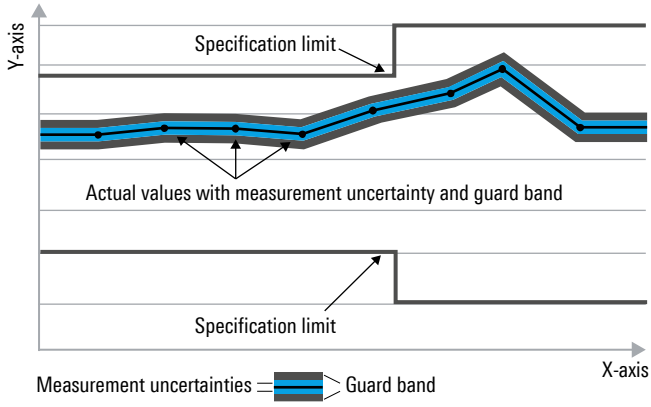
CONTENTS

Definitions

General
Product data applies under the following conditions:

- Three hours of storage at ambient temperature followed by 30 minutes of warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ±, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Non-traceable specifications with limits (n. trc.)
Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

Specifications

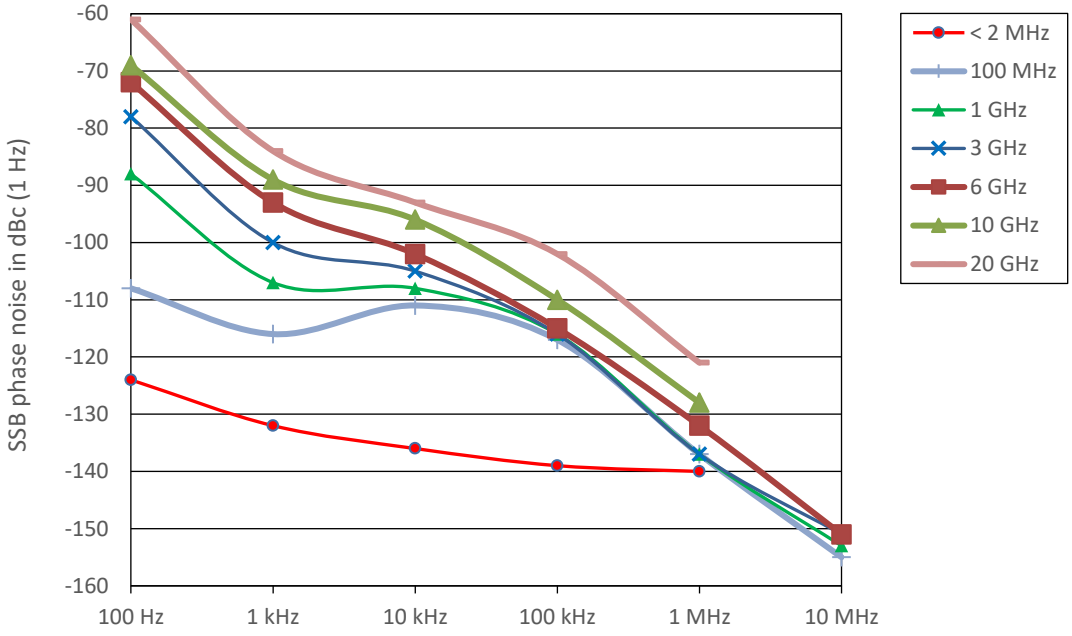
Frequency

Frequency range	R&S®FPL1003	5 kHz to 3 GHz
	R&S®FPL1007	5 kHz to 7.5 GHz
	R&S®FPL1014	5 kHz to 14 GHz
	R&S®FPL1026	5 kHz to 26.5 GHz
Frequency resolution		0.01 Hz
Scaling	standard	linear
	with R&S®FPL1-K54 option, RBW ≤ 1 MHz	linear, logarithmic

Reference frequency, internal, nominal		
Accuracy		(time since last adjustment × aging rate) + temperature drift + calibration accuracy
Aging per year	standard	1×10^{-6}
	with R&S®FPL1-B4 OCXO reference frequency option	1×10^{-7}
Temperature drift (0 °C to +50 °C)	standard	1×10^{-6}
	with R&S®FPL1-B4 OCXO reference frequency option	1×10^{-7}
Achievable initial calibration accuracy	standard	5×10^{-7}
	with R&S®FPL1-B4 OCXO reference frequency option	5×10^{-8}

Frequency readout		
Marker resolution		0.01 Hz
Uncertainty		±(marker frequency × reference uncertainty + 10 % × resolution bandwidth + ½ (span / (sweep points – 1)) + 1 Hz)
Number of sweep (trace) points	default value	1001
	range	101 to 100001
Number of measurement points	with R&S®FPL1-K54, active EMI measurement	101 to 200001
Marker tuning frequency step size	marker step size = sweep points	span / (sweep points – 1)
	marker step size = standard	span / (default sweep points – 1)
Frequency counter resolution		0.001 Hz
Count accuracy		±(frequency × reference uncertainty + ½ (last digit))
Display range for frequency axis		0 Hz, 10 Hz to max. frequency
Resolution		0.1 Hz
Maximum span deviation		0.1 %

Spectral purity		
SSB phase noise	frequency = 1000 MHz, carrier offset	
	100 Hz	–88 dBc (1 Hz) (nom.)
	1 kHz	< –99 dBc (1 Hz)
	10 kHz	< –105 dBc (1 Hz), –108 dBc (1 Hz) (typ.)
	100 kHz	< –110 dBc (1 Hz), –115 dBc (1 Hz) (typ.)
	1 MHz	< –130 dBc (1 Hz), –135 dBc (1 Hz) (typ.)
	10 MHz	–152 dBc (1 Hz) (nom.)



Measured SSB phase noise at different center frequencies

Sweep time

Range	span = 0 Hz	1 µs to 8000 s
	span ≥ 10 Hz, RBW ≥ 100 kHz	1 ms to 8000 s [1]
	span ≥ 10 Hz, RBW < 100 kHz	75 µs to 8000 s [2]
Sweep time accuracy	span = 0 Hz	0.1 % (nom.)
	span ≥ 10 Hz, RBW ≥ 100 kHz	3 % (nom.)

Resolution bandwidths

Sweep filters and FFT filters [3]		
Resolution bandwidths (–3 dB)	sweep filters	100 kHz to 10 MHz, in 1/2/3/5 sequence
	FFT filters	1 Hz to 50 kHz, in 1/2/3/5 sequence
Bandwidth uncertainty		< 3 % (nom.)
Shape factor 60 dB:3 dB		< 5 (nom.)

[1] Net sweep time without additional hardware settling time.

[2] Time for data acquisition for FFT calculation.

[3] At a filter bandwidth of ≤ 50 kHz the device automatically switches to FFT sweep mode.

Channel filters [3]		
Bandwidths (–3 dB)		100/200/300/500 Hz
		1/1.5/2/2.4/2.7/3/3.4/4/4.5/5/6/7.5/8.5/9/10/12.5/14/15/16/20/21/25/30/50/100/150/192/200/300/500 kHz
		1/1.228/1.5/2/3/3.75/5/10 MHz
Bandwidth uncertainty		< 2 % (nom.)
Shape factor 60 dB:3 dB		< 2 (nom.)

EMI filters [3] **(with R&S®FPL1-K54 option)**		
Bandwidths (–6 dB)		10/100/200 Hz
		1/9/10/100/120 kHz
		1 MHz
Bandwidth uncertainty		< 3 % (nom.)
Shape factor 60 dB:6 dB		< 4 (nom.)

Video bandwidths		1 Hz to 10 MHz, in 1/2/3/5 sequence

Signal analysis bandwidth (equalized)	R&S®FPL1003, R&S®FPL1007 ≤ 7.5 GHz; R&S®FPL1014, R&S®FPL1026 < 6 GHz	
	standard	10 MHz (nom.)
	with R&S®FPL1-B40 option	40 MHz (nom.)
	R&S®FPL1014, R&S®FPL1026 ≥ 6 GHz	
	standard	10 MHz (nom.)
	with R&S®FPL1-B40 and R&S®FPL1-B11 options, YIG preselector: off	40 MHz (nom.)

Level

Display range		displayed noise floor up to +30 dBm

Maximum input level		
DC voltage		50 V
CW RF power	RF preamplifier: off	
	RF attenuation: 0 dB	20 dBm (= 0.1 W)
	RF attenuation ≥ 10 dB	30 dBm (= 1 W)
	with R&S®FPL1-B22 option, RF preamplifier: on	
	RF attenuation: 0 dB	13 dBm (= 20 mW)
	RF attenuation ≥ 10 dB	23 dBm (= 200 mW)
Pulse spectral density	RF attenuation: 0 dB, RF preamplifier: off	97 dBµV/MHz
Maximum pulse voltage	RF attenuation ≥ 10 dB, RF preamplifier: off	150 V
Maximum pulse energy	RF attenuation ≥ 10 dB, pulse duration: 10 µs, RF preamplifier: off	1 mWs

Intermodulation		
1 dB compression of input mixer (two tone)	RF attenuation: 0 dB, RF preamplifier: off	+7 dBm (nom.)
Third-order intercept point (TOI)	RF attenuation: 0 dB, level = –20 dBm (both), $\Delta f > 5 \times$ RBW or 10 kHz, whichever is larger, RF preamplifier: off	
	10 MHz ≤ f_{in} < 300 MHz	> 13 dBm, 16 dBm (typ.)
	300 MHz ≤ f_{in} < 3 GHz	> 17 dBm, 20 dBm (typ.)
	3 GHz ≤ f_{in} < 6 GHz	> 15 dBm, 18 dBm (typ.)
	6 GHz ≤ f_{in} < 14 GHz	> 13 dBm, 18 dBm (typ.)
	14 GHz ≤ f_{in} < 20 GHz	> 12 dBm, 18 dBm (typ.)
	20 GHz ≤ f_{in} ≤ 26.5 GHz	13 dBm (nom.)
	with R&S®FPL1-B22 option, RF attenuation: 0 dB, level = –40 dBm (both), $\Delta f > 5 \times$ RBW or 10 kHz, whichever is larger, RF preamplifier: on	
	5 MHz ≤ f_{in} < 6 GHz	0 dBm (nom.)
	6 GHz ≤ f_{in} < 26.5 GHz	–6 dBm (nom.)
Second-harmonic intercept (SHI)	RF attenuation: 0 dB, level = –13 dBm, RF preamplifier: off	
	1 MHz < f_{in} < 900 MHz	45 dBm (nom.)
	900 MHz ≤ f_{in} ≤ 13.25 GHz	70 dBm (nom.)

Displayed average noise level (DANL)		
RF preamplifier off	RF attenuation: 0 dB, termination: 50 Ω, log. scaling, normalized to 1 Hz RBW, RBW = 1 kHz, VBW = 1 Hz, sample detector, +20 °C to +30 °C	
	R&S®FPL1003, R&S®FPL1007	
	5 kHz ≤ f < 100 kHz	–143 dBm (typ.)
	100 kHz ≤ f < 5 MHz	< –140 dBm, –143 dBm (typ.)
	5 MHz ≤ f < 3 GHz	< –149 dBm, –152 dBm (typ.)
	3 GHz ≤ f < 5 GHz	< –143 dBm, –146 dBm (typ.)
	5 GHz ≤ f ≤ 7.5 GHz	< –140 dBm, –143 dBm (typ.)
	R&S®FPL1014, R&S®FPL1026	
	5 kHz ≤ f < 100 kHz	–143 dBm (typ.)
	100 kHz ≤ f < 5 MHz	< –140 dBm, –143 dBm (typ.)
	5 MHz ≤ f < 3 GHz	< –147 dBm, –150 dBm (typ.)
	3 GHz ≤ f < 6 GHz	< –143 dBm, –146 dBm (typ.)
	6 GHz ≤ f < 14 GHz	< –141 dBm, –144 dBm (typ.)
	14 GHz ≤ f < 20 GHz	< –135 dBm, –140 dBm (typ.)
	20 GHz ≤ f ≤ 26.5 GHz	< –132 dBm, –135 dBm (typ.)
RF preamplifier on (gain: nom. 20 dB)	RF attenuation: 0 dB, termination: 50 Ω, log. scaling, normalized to 1 Hz RBW, RBW = 1 kHz, VBW = 1 Hz, sample detector, +20 °C to +30 °C	
	R&S®FPL1003, R&S®FPL1007	
	3 MHz ≤ f < 10 MHz	< –155 dBm, –158 dBm (typ.)
	10 MHz ≤ f < 2 GHz	< –163 dBm, –166 dBm (typ.)
	2 GHz ≤ f < 3 GHz	< –162 dBm, –165 dBm (typ.)
	3 GHz ≤ f < 5 GHz	< –158 dBm, –161 dBm (typ.)
	5 GHz ≤ f < 7 GHz	< –156 dBm, –159 dBm (typ.)
	7 GHz ≤ f < 7.5 GHz	< –155 dBm, –158 dBm (typ.)
	R&S®FPL1014, R&S®FPL1026	
	10 MHz ≤ f < 2 GHz	< –160 dBm, –163 dBm (typ.)
	2 GHz ≤ f < 6 GHz	< –158 dBm, –161 dBm (typ.)
	6 GHz ≤ f < 14 GHz	< –158 dBm, –163 dBm (typ.)
	14 GHz ≤ f < 18 GHz	< –158 dBm, –161 dBm (typ.)
	18 GHz ≤ f ≤ 26.5 GHz	< –156 dBm, –158 dBm (typ.)

Spurious responses	mixer level ≤ –13 dBm, sweep optimization: auto or dynamic, scaling linear	
Image response	10 MHz ≤ f ≤ 3 GHz	
	f_{in} – 2 × 4020.4 MHz (1st IF)	< –90 dBc (typ.)
	f_{in} – 2 × 820.4 MHz (2nd IF)	< –80 dBc
	f_{in} – 2 × 20.4 MHz (3rd IF), RBW ≤ 3 MHz	< –80 dBc
	3 GHz < f ≤ 14 GHz, RBW ≤ 3 MHz	< –70 dBc (typ.)
	14 GHz < f ≤ 26.5 GHz, RBW ≤ 3 MHz	< –65 dBc (typ.)
Intermediate frequency response	2 MHz ≤ f ≤ 3 GHz	
	4020.4 MHz (1st IF)	< –80 dBc (typ.)
	820.4 MHz (2nd IF)	< –80 dBc
	20.4 MHz (3rd IF)	< –80 dBc
	3 GHz < f ≤ 26.5 GHz	< –70 dBc
Residual spurious response	RF attenuation: 0 dB	
	f ≤ 1 MHz	< –90 dBm (nom.)
	f > 1 MHz	< –90 dBm
Local oscillator related spurious	f < 3 GHz	
	1 kHz ≤ carrier offset ≤ 10 MHz	< –70 dBc
	carrier offset > 10 MHz	< –80 dBc
	3 GHz ≤ f < 14 GHz	< –70 dBc (typ.)
	14 GHz ≤ f ≤ 26.5 GHz	< –67 dBc (typ.)
Other interfering signals		
Subharmonic of 1st LO	20 MHz ≤ f < 3 GHz, spurious at 4020.4 MHz – 2 × f_{in}	< –80 dBc (nom.)
Harmonic of 1st LO	20 MHz ≤ f < 3 GHz, mixer level < –25 dBm, spurious at f_{in} – 2010.2 MHz	< –80 dBc (nom.)

Level display		
Logarithmic level axis		1 dB to 200 dB, in 1 dB steps
Linear level axis		10 % of reference level per level division, 10 divisions or logarithmic scaling
Number of traces		6
Trace detector		max. peak, min. peak, auto peak (normal), sample, RMS, average
Trace functions		clear/write, max. hold, min. hold, average, view
EMI detectors	with R&S®FPL1-K54 option	quasi-peak, RMS-average, CISPR-average
Measurement marker detector	with R&S®FPL1-K54 option	max. peak, average, quasi-peak, RMS-average, CISPR-average
Setting range of reference level		–130 dBm to (–13 dBm + RF attenuation – RF preamplifier gain), in steps of 0.01 dB
Units of level axis		dBm, dBµV, dBmV, dBµA, dBpW, V, A, W

Level measurement uncertainty		
Absolute level uncertainty at 50 MHz	RBW = 10 kHz, level = –10 dBm, reference level = –10 dBm, RF attenuation: 10 dB	
	+20 °C to +30 °C	< 0.3 dB (σ = 0.1 dB)
	0 °C to +50 °C	< 0.5 dB (σ = 0.17 dB)
Frequency response referenced to 50 MHz	RF attenuation: 10/20/30/40 dB, RF preamplifier: off, +20 °C to +30 °C	
	5 kHz ≤ f < 3 MHz	< 1 dB (nom.)
	3 MHz ≤ f < 3 GHz	< 0.3 dB (σ = 0.1 dB)
	3 GHz ≤ f < 7.5 GHz	< 0.6 dB (σ = 0.2 dB)
	7.5 GHz ≤ f < 14 GHz	< 1.5 dB (σ = 0.5 dB)
	14 GHz ≤ f < 26.5 GHz	< 2.0 dB (σ = 0.66 dB)
	any setting of RF attenuation, RF preamplifier: off, 0 °C to +50 °C	
	5 kHz ≤ f < 3 GHz	< 1 dB (nom.)
	3 GHz ≤ f < 7.5 GHz	< 1.5 dB (nom.)
	7.5 GHz ≤ f < 14 GHz	< 2.5 dB (nom.)
	14 GHz ≤ f < 26.5 GHz	< 3.0 dB (nom.)
	RF attenuation ≤ 20 dB, RF preamplifier: on, +20 °C to +30 °C	
	3 MHz ≤ f < 3 GHz	< 0.6 dB (σ = 0.2 dB)
	3 GHz ≤ f < 7.5 GHz	< 1.0 dB (σ = 0.33 dB)
	7.5 GHz ≤ f < 14 GHz	< 2.5 dB (σ = 0.83 dB)
	14 GHz ≤ f < 26.5 GHz	< 3.0 dB (σ = 1.0 dB)
Attenuator switching uncertainty	f = 50 MHz, 0 dB to 45 dB, referenced to 10 dB attenuation	< 0.2 dB (σ = 0.07 dB)
Uncertainty of reference level setting		0 dB [4]
Bandwidth switching uncertainty	referenced to RBW = 10 kHz and sweep type: FFT	
	sweep type: FFT, RBW < 100 kHz	< 0.1 dB (nom.)
	sweep type: sweep, RBW ≥ 100 kHz	< 0.2 dB (nom.)

Nonlinearity of displayed level		
Logarithmic level display	S/N > 16 dB, 0 dB to –50 dB	< 0.1 dB (σ = 0.07 dB)
Linear level display	S/N > 16 dB, 0 dB to –70 dB	5 % of reference level (nom.)

Total measurement uncertainty	signal level: 0 dB to –50 dB below reference level, S/N > 20 dB, sweep time: auto, sweep type: FFT, RF attenuation: 10/20/30/40 dB, RF preamplifier: off, span / RBW < 100, confidence level: 95 %, +20 °C to +30 °C	
	1 MHz ≤ f < 3 GHz	0.5 dB
	3 GHz ≤ f < 7.5 GHz	0.8 dB
	7.5 GHz ≤ f < 14 GHz	1.2 dB
	14 GHz ≤ f < 26.5 GHz	1.8 dB

[4] The setting of the reference level affects only the graphical representation of the measurement result on the display, not the measurement itself. Therefore, the reference level setting causes no additional uncertainty in measurement results.

Measurement speed

Local measurement and display update rate	1001 sweep points, sweep optimization set to “speed”	1 ms (1000/s) (nom.)
Maximum sweep rate, remote operation [5, 6]	trace average: on	0.9 ms (1100/s) (nom.)
Remote measurement and LAN transfer [5]		3.2 ms (357/s) (nom.)
Marker peak search [5]		1.9 ms (nom.)
Center frequency tune + sweep + sweep data transfer [5]		16 ms (nom.)

Trigger functions

Trigger		
Trigger source		free run, video, external, IF power, I/Q power
Trigger offset	span ≥ 10 Hz	0 s to 20 s
	span = 0 Hz	(–sweep time) to 20 s
Maximum deviation of trigger offset		±10 ns
IF power trigger		
Sensitivity	minimum signal power	–60 dBm + RF attenuation – RF preamplifier gain
	maximum signal power	–15 dBm + RF attenuation – RF preamplifier gain
IF power trigger bandwidth	RBW > 5 MHz	40 MHz (nom.)
	RBW ≤ 5 MHz	6 MHz (nom.)
Gated sweep		
Gate source		video, external, IF power, I/Q power
Gate delay		0 s to 20 s, min. resolution: 10 ns
Gate length		10 ns to 20 s, min. resolution: 10 ns
Maximum deviation of gate length		±10 ns

I/Q data

Interface		GPIB or LAN interface
Memory length		max. 25 Msample I and Q
Word length of I/Q samples		14 bit
Sampling rate	standard	100 Hz to 16 MHz
	with R&S®FPL1-B40 option	100 Hz to 100 MHz
Maximum signal analysis bandwidth (equalized)	standard	12.8 MHz
	with R&S®FPL1-B40 option	40 MHz
Signal analysis bandwidth ≤ 10 MHz, R&S®FPL1003 and R&S®FPL1007		
Amplitude flatness	f_{center} ≥ 12 MHz and (1.25 × signal analysis bandwidth)	±0.3 dB (nom.)
Deviation from linear phase	f_{center} ≥ 12 MHz and (1.25 × signal analysis bandwidth)	±1° (nom.)
Signal analysis bandwidth ≤ 10 MHz, R&S®FPL1014 and R&S®FPL1026		
Amplitude flatness	f_{center} ≥ 30 MHz and (1.25 × signal analysis bandwidth)	±1.0 dB (nom.)
Deviation from linear phase	f_{center} ≥ 30 MHz and (1.25 × signal analysis bandwidth)	±2° (nom.)
Signal analysis bandwidth ≤ 40 MHz, R&S®FPL1003 and R&S®FPL1007		
Amplitude flatness	f_{center} ≥ 12 MHz and (1.25 × signal analysis bandwidth)	±0.5 dB (nom.)
Deviation from linear phase	f_{center} ≥ 12 MHz and (1.25 × signal analysis bandwidth)	±1.5° (nom.)
Signal analysis bandwidth ≤ 40 MHz, R&S®FPL1014 and R&S®FPL1026, f_{center} ≤ 6 GHz		
Amplitude flatness	f_{center} ≥ 30 MHz and (1.25 × signal analysis bandwidth)	±0.5 dB (nom.)
Deviation from linear phase	f_{center} ≥ 30 MHz and (1.25 × signal analysis bandwidth)	±1.5° (nom.)

[5] Measured with a PC equipped with Intel Core i7 2.8 GHz and 1 Gigabit LAN interface.

[6] Measurement is performed with a sweep count of 1000. The indicated speed is the average speed of 1 sweep.

Signal analysis bandwidth ≤ 40 MHz, R&S®FPL1014 and R&S®FPL1026, f_{center} > 6 GHz, YIG preselector: off [7]		
Amplitude flatness		±1.5 dB (nom.)
Deviation from linear phase		±3° (nom.)

Inputs and outputs

RF input		
Impedance		50 Ω
Connector	R&S®FPL1003, R&S®FPL1007, R&S®FPL1014	type N female
	R&S®FPL1026	test port adapter, PC 2.92 mm female (interchangeable port connector system)
VSWR	RF attenuation ≥ 10 dB	
	10 MHz ≤ f < 3 GHz	< 1.5 (nom.)
	3 GHz ≤ f < 7.5 GHz	< 2 (nom.)
	7.5 GHz ≤ f < 26.5 GHz	< 2 (nom.)
Setting range of attenuator	standard	0 dB to 45 dB, in 5 dB steps
	with R&S®FPL1-B25 option	0 dB to 45 dB, in 1 dB steps
RF preamplifier gain	with R&S®FPL1-B22 option	20 dB (nom.)

USB interface		4 ports, type A plug, version 2.0

Reference output		
Connector		BNC female
Impedance		50 Ω
Output frequency	internal reference	10 MHz
	external reference	same as reference input signal
Level		> 0 dBm (nom.)

Reference input		
Connector		BNC female
Impedance		50 Ω
Input frequency range		10 MHz ± 5 ppm
Required level		> 0 dBm into 50 Ω

External trigger/gate input		
Connector		BNC female
Trigger voltage		0.5 V to 3.5 V
Input impedance		10 kΩ

LAN interface		10/100/1000BASE-T
Connector		RJ-45

External monitor		
Connector		DVI-D

[7] R&S®FPL1-B11 option required.

General data

Display		21 cm LC TFT color display (10.1")
Resolution		1280 × 800 pixel (WXGA resolution)
Pixel failure rate		< 1 × 10^{-5}

Data storage		
Internal	standard	solid-state drive (SSD), 32 Gbyte
External		supports USB 2.0 compatible memory devices

Environmental conditions		
Temperature	operating temperature range	0 °C to +50 °C
	storage temperature range	–20 °C to +70 °C
Damp heat	without condensation	+40 °C at 85 % rel. humidity, in line with EN 60068-2-30

Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm constant amplitude (1.8 g at 55 Hz); 55 Hz to 150 Hz, acceleration: 0.5 g constant; in line with EN 60068-2-6
	random	8 Hz to 500 Hz, acceleration: 1.2 g (RMS), in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I, MIL-PRF-28800F

EMC		in line with EMC Directive 2014/30/EU including • IEC/EN 61326-1 [8, 9] • IEC/EN 61326-2-1 • CISPR 11/EN 55011 [8] • IEC/EN 61000-3-2 • IEC/EN 61000-3-3

Recommended calibration interval		1 year

Power supply		
AC supply		100 V to 240 V ± 10 %, 50 Hz to 60 Hz ± 5 %
Safety		in line with • EN 61010-1 • IEC 61010-1 • UL 61010-1 • CAN/CSA-C22.2 No. 61010-1
Test marks		CE, $_{C}$CSA$_{US}$, KCC

Power consumption		
Operating	R&S®FPL1003, R&S®FPL1007	65 W (nom.), max. 115 W with all options [10]
	R&S®FPL1014	80 W (nom.), max. 130 W with all options [10]
	R&S®FPL1026	85 W (nom.), max. 140 W with all options [10]

[8] Emission limits for class A equipment.

[9] Immunity test requirement for industrial environment (EN 61326, table 2).

[10] Power consumption varies depending on mode of operation and options installed. The specified maximum power consumption includes R&S®FPL1-B31 option with both batteries in charge mode.

Non-operating	standby (all models)	
	without R&S®FPL1-B4 option	5 W (nom.)
	with R&S®FPL1-B4 option	8 W (nom.)
	internal battery (R&S®FPL1-B31 option) in charge mode	85 W (nom.)
	power off (all models)	0 W (nom.)

Dimensions and weight		
Dimensions	W × H × D	408 mm × 186 mm × 235 mm (16.06 in × 7.32 in × 9.25 in)
Net weight without options, nominal	R&S®FPL1003, R&S®FPL1007	6 kg (13.22 lb)
	R&S®FPL1014, R&S®FPL1026	7 kg (15.43 lb)
Net weight with internal battery, nominal	R&S®FPL1003, R&S®FPL1007	7.3 kg (16 lb)
	R&S®FPL1014, R&S®FPL1026	8.3 kg (17.64 lb)

Options

R&S®FPL1-B5 additional interfaces

User port		
Connector		25-pin D-Sub female
Output		TTL-compatible, 0 V/5 V, max. 15 mA
Input		TTL-compatible, max. 5 V

Noise source control and power sensor		
Connectors	for R&S®FS-SNSxx smart noise sources and R&S®NRP-Zxx power sensors	7-pin LEMOSA female
	for noise source control	BNC female
Noise source control output voltage		0 V/28 V, switchable, max. 100 mA (nom.)

IF/Video/Demod Out		
Connector		BNC female, 50 Ω
IF Out		
Bandwidth		equal to RBW setting
IF frequency		25 MHz
Output level	center frequency > 10 MHz, span = 0 Hz, signal at reference level and center frequency	0 dBm (nom.)
Video Out		
Bandwidth		equal to VBW setting
Output scaling	log. display scale	logarithmic
	lin. display scale	linear
Output level	center frequency > 10 MHz, span = 0 Hz, signal at reference level and center frequency	1 V, open-circuit (nom.)

Audio output		
Loudspeaker		built-in, adjustable
AF out		
Connector		3.5 mm mini jack
Output impedance		10 Ω
Open-circuit voltage		up to 1.5 V, adjustable

R&S®FPL1-B9 internal generator

Frequency		
Frequency range	R&S®FPL1003	5 kHz to 3 GHz
	R&S®FPL1007, R&S®FPL1014, R&S®FPL1026	5 kHz to 7.5 GHz
Setting resolution	independent CW source	0.01 Hz

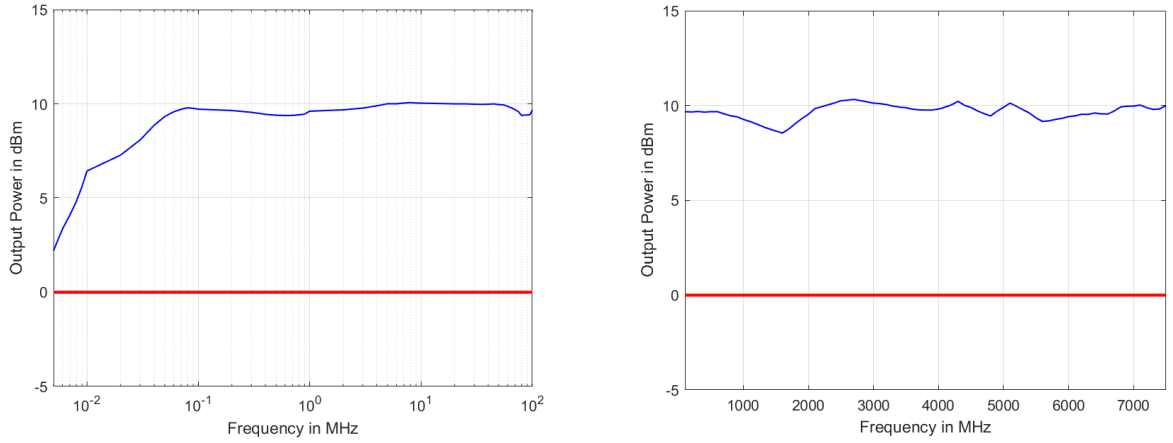
Frequency offset		
Setting range		0 Hz to f_{max} [11]
Setting resolution		0.01 Hz

Spectral purity		
SSB phase noise	frequency = 1 GHz, output level = 0 dBm	
	carrier offset = 10 kHz	< –102 dBc (1 Hz), –108 dBc (1 Hz) (typ.)
	carrier offset = 100 kHz	< –105 dBc (1 Hz), –111 dBc (1 Hz) (typ.)
	carrier offset = 1 MHz	< –117 dB (1 Hz), –130 dBc (1 Hz) (typ.)
Harmonics	output level = 0 dBm, +20 °C to +30 °C	
	5 kHz ≤ f < 100 kHz	< –30 dBc (nom.)
	100 kHz ≤ f ≤ 7.5 GHz [12]	< –30 dBc
Non-harmonic spurious	output level = 0 dBm	
	1 kHz < offset from carrier ≤ 4 MHz	–35 dBc (nom.)
	offset from carrier > 4 MHz	< –35 dBc, –45 dBc (typ.)

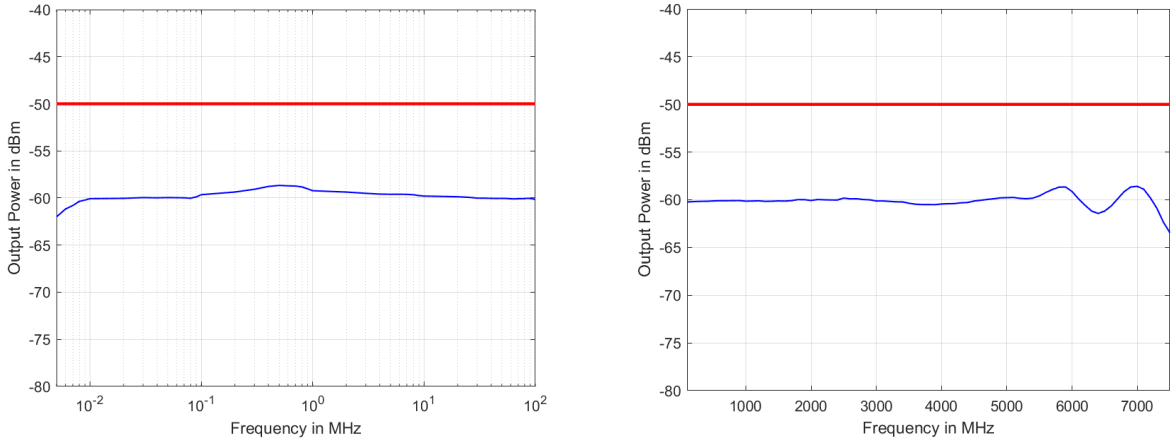
Level		
Specified level range		–50 dBm to 0 dBm
Setting resolution		0.1 dB
Setting range		–60 dBm to +10 dBm
Absolute level uncertainty	frequency = 50 MHz, +20 °C to +30 °C, output level = –10 dBm, frequency offset = 0 Hz	< 0.5 dB
Frequency response	output level = –10 dBm, referenced to level at 50 MHz, +20 °C to +30 °C, frequency offset = 0 Hz	
	100 kHz ≤ f ≤ 3 GHz	< 1 dB,
	3 GHz < f ≤ 7.5 GHz	< 1.5 dB, < 1 dB (typ.)
Level nonlinearity	for specified level range, referenced to –10 dBm output level, +20 °C to +30 °C, f ≥ 100 kHz	≤ 2 dB, < 0.5 dB (typ.)

[11] f_{max} depends on frequency range.

[12] Limit is nominal for harmonics at frequencies > 20 GHz.



Maximum output power versus frequency, level in dBm (meas.)



Minimum output power versus frequency, level in dBm (meas.)

Dynamic range	RBW = 1 kHz, f = 1 GHz	115 dB (nom.)

Power sweep		
Specified level range		–50 dBm to 0 dBm
Setting resolution		0.1 dB
Setting range		–60 dBm to +10 dBm

GEN output		
Connector		type N female, 50 Ω
VSWR		1.5 (nom.)

Reverse power		
DC voltage		50 V
CW RF power		30 dBm (= 1 W)
Maximum pulse voltage		150 V
Maximum pulse energy	pulse duration: 10 µs	1 mWs

R&S®FPL1-B10 GPIB interface

IEC/IEEE bus control		interface in line with IEC 625-2 (IEEE-488.2)
Command set		SCPI 1997.0
Connector		24-pin Amphenol female
Interface functions		SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0

R&S®FPL1-B30 DC power input 12 V/24 V

Input voltage range	DC	12 V to 24 V (nom.), 10.4 V to 28 V, switch-on voltage > 11 V (meas.)
Input current	V_{in} = 12 V/24 V	15 A/7.5 A (nom.)
	V_{in} = 12 V/24 V, operating mode, without internal batteries (R&S®FPL1-B31); R&S®FPL1003, R&S®FPL1007	5.5 A/2.7 A (meas.)
	V_{in} = 12 V/24 V, operating mode, without internal batteries (R&S®FPL1-B31); R&S®FPL1014, R&S®FPL1026	6.8 A/3.5 A (meas.)
	V_{in} = 12 V/24 V, operating mode, internal batteries in charge mode; R&S®FPL1003, R&S®FPL1007	11 A/5 A (meas.)
	V_{in} = 12 V/24 V, operating mode, internal batteries in charge mode; R&S®FPL1014, R&S®FPL1026	11.8 A/5.4 A (meas.)
	V_{in} = 12 V/24 V, instrument standby mode, internal batteries in charge mode	6.5 A/3 A (meas.)
Temperature	operating temperature range	0 °C to +40 °C
	storage temperature range	–20 °C to +70 °C

R&S®FPL1-B31 internal lithium-ion battery

Operating time	R&S®FPL1003, R&S®FPL1007	3.5 h (nom.)
	R&S®FPL1014, R&S®FPL1026	2.0 h (nom.)
Charge time	standby mode, AC supply	< 2 h (nom.)
	standby mode, external DC supply (R&S®FPL1-B30)	< 2 h (nom.)
	operating mode	< 4 h (nom.)
Temperature	operating temperature range, discharge	0 °C to +50 °C
	operating temperature range, charge	0 °C to +40 °C
	storage temperature range	–20 °C to +60 °C [13]

R&S®FSV-B34 charger (only needed for charging spare batteries)

AC input voltage range		100 V to 240 V ± 10 % (nom.)
AC supply frequency		50 Hz to 60 Hz (nom.)
Power consumption		max. 300 W (nom.)
Number of charger bays		4
Dimensions	W × H × D	400 mm × 127 mm × 203 mm (15.75 in × 5 in × 8 in)
Net weight		3.1 kg (6.9 lb)

[13] The battery packs should be stored in an environment with low humidity, free from corrosive gas at a recommended temperature range < +21 °C. Extended exposure to temperatures above +45 °C could degrade battery performance and life.

Ordering information

Designation	Type	Order No.
Spectrum analyzer	R&S®FPL1003	1304.0004.03
Spectrum analyzer	R&S®FPL1007	1304.0004.07
Spectrum analyzer	R&S®FPL1014	1304.0004.14
Spectrum analyzer	R&S®FPL1026	1304.0004.26
Accessories supplied		
Power cable and quick start guide		

Options

Designation	Type	Order No.	Retrofittable	Remarks
OCXO reference frequency	R&S®FPL1-B4	1323.1902.02	yes	retrofit in service center
Additional interfaces	R&S®FPL1-B5	1323.1883.02	yes	user-retrofittable IF/Video/Demod Out, user port, noise source control, power sensor, AF output, loudspeaker
Internal generator	R&S®FPL1-B9	1323.1925.03	no	for R&S®FPL1003
Internal generator	R&S®FPL1-B9	1323.1925.07	no	for R&S®FPL1007, R&S®FPL1014 and R&S®FPL1026
GPIB interface	R&S®FPL1-B10	1323.1890.02	yes	user-retrofittable
YIG preselector bypass	R&S®FPL1-B11	1323.1619.02	yes	user-retrofittable
External generator control	R&S®FPL1-B12	1353.6660.02	yes	user-retrofittable
Second hard disk (SSD)	R&S®FPL1-B19	1304.0427.02	yes	user-retrofittable mounted on PC board, including analyzer firmware
RF preamplifier (3 GHz/7.5 GHz)	R&S®FPL1-B22	1323.1719.02	yes	user-retrofittable
RF preamplifier (14 GHz)	R&S®FPL1-B22	1323.1702.02	yes	user-retrofittable
RF preamplifier (26.5 GHz)	R&S®FPL1-B22	1323.1777.02	yes	user-retrofittable
1 dB steps for electronic attenuator	R&S®FPL1-B25	1323.1990.02	yes	user-retrofittable
DC power supply 12 V/24 V	R&S®FPL1-B30	1323.1877.02	yes	user-retrofittable
Internal lithium-ion battery	R&S®FPL1-B31	1323.1725.02	yes	retrofit in service center; including 2 battery packs and internal charging unit
40 MHz analysis bandwidth	R&S®FPL1-B40	1323.1931.02	yes	user-retrofittable
Firmware				
AM/FM/PM measurement demodulator	R&S®FPL1-K7	1323.1731.02		
Power sensor measurement with R&S®NRPxx power sensors	R&S®FPL1-K9	1323.1754.02		supports R&S®NRPxx power sensors
Noise figure and gain measurements	R&S®FPL1-K30	1323.1760.02		requires R&S®FPL1-B5
Security write protection for SSD	R&S®FPL1-K33	1323.1290.02		requires Windows 10 IoT Enterprise LTSC 2021 operating system or R&S®FPL1-U10
Phase noise measurement application	R&S®FPL1-K40	1323.1831.02		
EMI measurement application	R&S®FPL1-K54	1323.1783.02		
Vector signal analysis	R&S®FPL1-K70	1323.1748.02		
Multi-modulation analysis	R&S®FPL1-K70M	1323.1625.02		requires R&S®FPL1-K70
BER measurements with PRBS data	R&S®FPL1-K70P	1323.1631.02		requires R&S®FPL1-K70
Software				
License dongle	R&S®FSPC	1310.0002.03		
Vector signal explorer base software	R&S®VSE	1320.7500.06		
Vector signal analysis	R&S®VSE-K70	1320.7522.06		
EUTRA/LTE NB-IoT	R&S®VSE-K106	1320.7900.06		

Upgrades

Designation	Type	Order No.	Retrofittable	Remarks
Upgrade to Windows IoT Enterprise LTSC 2021	R&S®FPL1-U10	1353.5393.21	yes	contact the Rohde & Schwarz service center

Recommended extras

Designation	Type	Order No.
Protective hard cover	R&S®FPL1-Z1	1323.1960.02
Soft carrying bag for transport and outdoor operation	R&S®FPL1-Z2	1323.1977.02
H-style shoulder harness (requires R&S®FPL1-Z2 option)	R&S®FPL1-Z3	1323.1683.02
Spare lithium-ion battery pack	R&S®FPL1-Z4	1323.1677.02
Lithium-ion battery charger for charging spare batteries	R&S®FSV-B34	1321.3950.02
19" rackmount kit (RAL 5014) [14]	R&S®FPL1-Z6	1323.1954.02
19" rackmount kit (RAL 5000) [14]	R&S®FPL1-Z6B	1323.1954.03
D-Sub cable for TTL synchronization [15]	R&S®FPL1-Z7	1353.6648.02
Headphone		0708.9010.00
Adapters for instruments with test-port adapter (R&S®FPL1026)		
Test port adapter, 2.92 mm female		1036.4790.00
Test port adapter, 2.92 mm male		1036.4802.00
Test port adapter, 18 GHz, type N female [16]		1036.4777.00
Matching pads, 50 Ω/75 Ω		
L section, matching at both ends	R&S®RAM	0358.5414.02
Series resistor, 25 Ω, matching at one end (taken into account in instrument function RF INPUT 75 Ω)	R&S®RAZ	0358.5714.02
Smart noise sources for noise figure and gain measurements (R&S®FPL1-K30 required)		
Smart noise source, 10 MHz to 18 GHz	R&S®FS-SNS18	1338.8008.18
Smart noise source, 10 MHz to 26.5 GHz	R&S®FS-SNS26	1338.8008.26
Probe adapters		
Type N adapter, for R&S®RT-Zxx oscilloscope probes (recommended for R&S®FPL1003, R&S®FPL1007 and R&S®FPL1014)	R&S®RT-ZA9	1417.0909.02
Type 3.5 mm (f) adapter, for R&S®RT-Zxx oscilloscope probes (recommended for R&S®FPL1026)	R&S®RT-ZA51	1803.5365.02
High-power attenuators		
Attenuator 100 W, 3/6/10/20/30 dB, 1 GHz	R&S®RBU100	1073.8495.xx (xx = 03/06/10/20/30)
Attenuator 50 W, 3/6/10/20/30 dB, 2 GHz	R&S®RBU50	1073.8695.xx (xx = 03/06/10/20/30)
Attenuator 50 W, 20 dB, 6 GHz	R&S®RDL50	1035.1700.52
Cables		
IEC/IEEE bus cable, length: 1 m	R&S®PCK	0292.2013.10
IEC/IEEE bus cable, length: 2 m	R&S®PCK	0292.2013.20
DC block		
DC block, 10 kHz to 18 GHz, type N	R&S®FSE-Z4	1084.7443.03

[14] R&S®FPL1-Z6B is available for instruments in the current corporate design color RAL 5000 (violet blue), while R&S®FPL1-Z6 is available for the legacy color RAL 5014 (pigeon blue).

[15] R&S®FPL1-B5 option required.

[16] The type N connector is only specified for frequencies up to 18 GHz. Degradations in expected performance may occur when using this adapter at higher frequencies.

Power sensors supported by the R&S®FPL1-K9 option [17]

Designation	Type	Order No.
Universal power sensors		
1 nW to 100 mW, 10 MHz to 8 GHz, two-path	R&S®NRP-Z211	1417.0409.02
200 pW to 200 mW, 10 MHz to 8 GHz [18]	R&S®NRP-Z11	1138.3004.02
1 nW to 100 mW, 10 MHz to 18 GHz, two-path	R&S®NRP-Z221	1417.0309.02
200 pW to 200 mW, 10 MHz to 18 GHz [18]	R&S®NRP-Z21	1137.6000.02
2 nW to 2 W, 10 MHz to 18 GHz [18]	R&S®NRP-Z22	1137.7506.02
20 nW to 15 W, 10 MHz to 18 GHz [18]	R&S®NRP-Z23	1137.8002.02
60 nW to 30 W, 10 MHz to 18 GHz [18]	R&S®NRP-Z24	1137.8502.02
Power sensor modules with power splitter		
4 µW to 400 mW, DC to 18 GHz	R&S®NRP-Z27	1169.4102.02
4 µW to 400 mW, DC to 26.5 GHz	R&S®NRP-Z37	1169.3206.02
Thermal power sensors		
300 nW to 100 mW, DC to 18 GHz	R&S®NRP18T	1424.6115.02
300 nW to 100 mW, DC to 18 GHz, LAN version	R&S®NRP18TN	1424.6121.02
300 nW to 100 mW, DC to 33 GHz	R&S®NRP33T	1424.6138.02
300 nW to 100 mW, DC to 33 GHz, LAN version	R&S®NRP33TN	1424.6144.02
300 nW to 100 mW, DC to 40 GHz,	R&S®NRP40T	1424.6150.02
300 nW to 100 mW, DC to 40 GHz, LAN version	R&S®NRP40TN	1424.6167.02
300 nW to 100 mW, DC to 50 GHz,	R&S®NRP50T	1424.6173.02
300 nW to 100 mW, DC to 50 GHz, LAN version	R&S®NRP50TN	1424.6180.02
300 nW to 100 mW, DC to 67 GHz	R&S®NRP67T	1424.6196.02
300 nW to 100 mW, DC to 67 GHz, LAN version	R&S®NRP67TN	1424.6209.02
300 nW to 100 mW, DC to 90 GHz	R&S®NRP90T	1424.6473.02
300 nW to 100 mW, DC to 90 GHz, LAN version	R&S®NRP90TN	1424.6480.02
300 nW to 100 mW, DC to 110 GHz	R&S®NRP110T	1424.6215.02
Average power sensors		
100 pW to 200 mW, 8 kHz to 6 GHz	R&S®NRP6A	1424.6796.02
100 pW to 200 mW, 8 kHz to 6 GHz, LAN version	R&S®NRP6AN	1424.6809.02
100 pW to 200 mW, 9 kHz to 6 GHz [18]	R&S®NRP-Z91	1168.8004.02
100 pW to 200 mW, 8 kHz to 18 GHz	R&S®NRP18A	1424.6815.02
100 pW to 200 mW, 8 kHz to 18 GHz, LAN version	R&S®NRP18AN	1424.6821.02
Three-path diode power sensors		
100 pW to 200 mW, 10 MHz to 8 GHz	R&S®NRP8S	1419.0006.02
100 pW to 200 mW, 10 MHz to 8 GHz, LAN version	R&S®NRP8SN	1419.0012.02
100 pW to 200 mW, 10 MHz to 18 GHz	R&S®NRP18S	1419.0029.02
100 pW to 200 mW, 10 MHz to 18 GHz, LAN version	R&S®NRP18SN	1419.0035.02
1 nW to 2 W, 10 MHz to 18 GHz	R&S®NRP18S-10	1424.6721.02
10 nW to 15 W, 10 MHz to 18 GHz	R&S®NRP18S-20	1424.6738.02
30 nW to 30 W, 10 MHz to 18 GHz	R&S®NRP18S-25	1424.6744.02
100 pW to 200 mW, 10 MHz to 33 GHz	R&S®NRP33S	1419.0064.02
100 pW to 200 mW, 10 MHz to 33 GHz, LAN version	R&S®NRP33SN	1419.0070.02
100 pW to 200 mW, 10 MHz to 33 GHz, LAN version, TVAC-compliant	R&S®NRP33SN-V	1419.0129.02
100 pW to 100 mW, 50 MHz to 40 GHz	R&S®NRP40S	1419.0041.02
100 pW to 100 mW, 50 MHz to 40 GHz, LAN version	R&S®NRP40SN	1419.0058.02
100 pW to 100 mW, 50 MHz to 50 GHz	R&S®NRP50S	1419.0087.02
100 pW to 100 mW, 50 MHz to 50 GHz, LAN version	R&S®NRP50SN	1419.0093.02
100 pW to 100 mW, 50 MHz to 67 GHz	R&S®NRP67S	1424.6396.02
100 pW to 100 mW, 50 MHz to 67 GHz, LAN version	R&S®NRP67SN	1424.6409.02
100 pW to 200 mW, 50 MHz to 67 GHz, LAN version, TVAC-compliant	R&S®NRP67SN-V	1424.6415.02
Wideband power sensors		
1 nW to 100 mW, 50 MHz to 18 GHz [18]	R&S®NRP-Z81	1137.9009.02
1 nW to 100 mW, 50 MHz to 40 GHz, 2.92 mm [18]	R&S®NRP-Z85	1411.7501.02
1 nW to 100 mW, 50 MHz to 40 GHz, 2.40 mm [18]	R&S®NRP-Z86	1417.0109.40
1 nW to 100 mW, 50 MHz to 44 GHz, 2.40 mm [18]	R&S®NRP-Z86	1417.0109.44

[17] For average power measurement only. LAN connection not supported.

[18] Product discontinued.

Warranty and service

Warranty		
Base unit		1 year
All other items		1 year
Service options		
	Service plans	**On demand**
Calibration	up to five years [19]	pay per calibration
Warranty and repair	up to five years [19]	standard price repair
Contact your Rohde & Schwarz sales office for further details.		

[19] For extended periods, contact your Rohde & Schwarz sales office.

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